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METHOD FOR ASBESTOS IN WATER SUPPLIES RECOMMENDED BY THE MINISTRY COMMITTEE ON ASBESTOS ANALYSIS

Asbestos includes two types or groups of fibrous silicate minerals, possessing special thermal and electrical properties. It is used in a wide variety of products including insulation, brake linings, fireproof clothing and protectors and building materials. The occurrence of asbestos as a pollutant in water supplies and ambient air has caused considerable concern. Occupational exposure to airborne asbestos fibres is known to produce adverse health effects.

Recognizing the importance of asbestos as an environmental contaminant and the need for consistency and reliability of analytical results, the Ontario Ministry of the Environment in 1976 established and funded a committee on asbestos analysis. The committee includes representatives from six Ontario laboratories with expertise in the analysis of asbestos in environmental samples. The aims of the committee are to investigate problems associated with asbestos analysis and to reach a consensus on the state of the art methods suitable for the routine analysis of asbestos in water and ambient air.

A method for asbestos in water has now been selected and adapted by the committee and is detailed in a Ministry report, "An Interim Method for the Determination of Asbestos Fibre Concentrations in Water by Transmission Electron Microscopy".

A second report, "Inter-laboratory Comparison of Selected Methods for the Determination of Asbestos Fibre Concentrations in Water", has also been prepared and presents the results of the tests and analyses of data upon which the selection of the committee method was based.

Methodology for asbestos in air is currently under development by the committee and a report is expected to be issued this year.

Attempts to quantify asbestos in water supplies in Ontario have been hampered because widely divergent results have been obtained by different laboratories analyzing identical water samples. The analytical procedures used by the various laboratories were found to differ in the manner of sample preparation and also with respect to the criteria used for fibre enumeration and identification.

In the investigation connected with the selection of the water method, an extensive series of tests was carried out, over an 18-month period, on prepared suspensions of asbestos fibres in water and on water samples from Lloyd lake (vicinity of Matachewan, Ontario), Thunder Bay, Ontario and Duluth, Minnesota. Transmission electron microscopy was selected as the best means of counting, sizing and identifying asbestos fibres in the size range encountered in environmental samples.

The method involves filtering a known volume of water through a membrane filter with a pore size of 0.1 um in such a manner as to distribute particulate material, including asbestos, uniformly on the filter surface. The particulate material is then fixed on the filter by means of a thin coating of carbon. A small section of the carbon-coated filter is placed on a transmission electron microscope grid and the filter matrix is dissolved by means of chloroform.

The prepared grid is examined in a transmission electron microscope and the asbestos fibres are counted, sized and identified at a magnification of 20,000 X.

Chrysotile fibres may be identified by their morphology only, subject to confirmation of the identity of a portion of the fibres by both their morphology and selected area electron diffraction patterns. Amphibole fibres are identified by both their morphology and selected area electron diffraction patterns. Usually, about 100 fibres in four to twenty grid openings are examined. Concentrations are reported in terms of million fibres per litre and in micrograms per litre for chrysotile, amphibole and total asbestos.

A range of concentrations of about 0.1 - 1,000 million fibres per litre can be determined without resorting to dilution of the original water sample. A detection limit of 0.1 million fibres per litre may be achieved if sufficient sample volume is used and a blank level of one fibre in twenty grid openings can be obtained.

In the study, the intra- and inter-laboratory precisions of the method, expressed as relative standard deviation, were found to be approximately 25 and 50 percent, respectively, for total asbestos concentrations in the range of 40 to 310 million fibres per litre.

It was not possible to determine the accuracy of the method. However, results obtained by the method and two different methods using transmission electron microscopy were found to be comparable when identical water samples were analyzed.

(Pang - 248-7101)

THE DETERMINATION OF LEAD IN AIR PARTICULATE MATTER BY X-RAY FLUORESCENCE SPECTROMETRY.

Elevated levels of lead have been found in the vicinity of lead smelting operations and heavily travelled highways. The effective monitoring of these lead levels required that relatively large numbers of samples be collected and analyzed. The current Ontario ambient air quality criterion for lead in suspended air particulate matter is 5.0 ug Pb/m^3 of air, averaged over a 24-hour period. To monitor the lead levels, samples are collected on glass fibre filters (20 cm x 25 cm), using a high volume air sampler. The method routinely used to analyze the deposit on the filters involves acid treatment of filter aliquots and atomic absorption spectrometry (AAS).

The large numbers of samples being received led to an investigation of X-ray fluorescence spectrometry (XRF) as a means of decreasing analytical throughput time. In developing the technique, it was found that sample pre-treatment was not necessary.

A calibration curve, obtained by analyzing about 80 high volume filters having lead levels in the range of 0 to 50,000 ug per filter using AAS and XRF techniques, was found to be linear in the range 0 to 10,000 ug per filter. For the XRF analysis, a circular aliquot of the filter was placed in the spectrometer and the number of counts for a period of 40 seconds was obtained. The following instrumental conditions were used:

X-Ray tube	- Chromium anode
Power	- 50 KV 40 mA
Detector	- Scintillation counter
Analytical Line	- Pb-L beta. The L alpha line cannot be used, owing to arsenic interference
Crystal	- Lithium fluoride 200

In the spectrometer used, a Siemens SRS machine, the X-ray tube is situated below the sample holder. It was found that material was lost from the filter when the dust-containing side faced the tube and samples were therefore analyzed with the clean side exposed to the X-ray beam.

For the AAS technique, separate aliquots from the same filter, as well as those used for the XRF examination were treated with nitric acid and the resulting solutions analyzed for lead using an air-acetylene flame and a wavelength setting of 283.3 nm.

The best method of standardization was to use the same filter aliquot for the X-ray and subsequent AAS analysis.

The great majority ($>$90%) of analyses for lead in ambient air gave results in the linear calibration range (effectively up to 5 ug Pb/m^3 of air), so it was decided to utilize the XRF method for samples in this concentration range, and to continue to use the AAS technique for those samples giving

XRF counts above the range, and for quality control purposes.

The linear regression analysis of results from the two methods indicated good agreement, the correlation coefficient (r) being 0.97. The sample throughput by the XRF technique is approximately 125 per man-day day including analysis and data entry for a computer print-out of the final report.

Investigations are currently being conducted to extend the range of the XRF method.

(Pimenta- 248-7101).

DRINKING WATER TESTING IS IMPROVED BY 'P-A' METHOD

Testing drinking water for bacterial pollution was made more efficient, and less costly with the introduction at the MOE laboratories of the very sensitive Presence-Absence (P-A) method of detection.

In the standard membrane filter (MF) testing procedure – widely used throughout North America – bacteria are filtered from the water sample onto a membrane filter, which is then placed on a nutritive medium. Following an incubation period, a differential count of bacterial colonies determines if the water supply is suitable for drinking purposes.

MOE microbiologists found the MF method generally satisfactory for testing raw water samples where the incidence of coliform bacteria was relatively high, but its use for testing treated water samples, which usually gave negative results, was considered wasteful of costly material.

The need for a method which would indicate accurately, and with a minimum of effort, whether or not pollution indicator bacteria were present, was clearly evident. With the development of the P-A test, not only was a relatively inexpensive and fast method of analysis achieved, but the P-A test proved to be more sensitive than the standard MF procedure.

In the P-A test, a 100 ml sample is transferred to a bottle containing a medium which supports the growth of pollution indicator bacteria. A positive reading is indicated by a colour change in the medium and/or the production of gas. Positive readings are then confirmed to determine which bacteria are present. If the reading is negative, little staff time is lost in taking results.

Rather than terminating the analysis after 24 hours, as in the MF test, each P-A test is allowed to run four days. This permits the detection of lower levels of coliforms than the MF test and in addition, of fecal coliforms, fecal streptococci, fluorescent pseudomonads and even clostridium bacteria associated with remote fecal pollution. The detection of these additional bacteria would not be feasible by the MF procedure because of the heavy demands it would place on staff time and materials necessary to carry out the separate tests required to detect each of the bacterial groups.

Development of the P-A test commenced 12 years ago and it has been used by MOE routinely for 10 years. Raw water samples are still analysed for coliforms by MF tests, and P-A tests are also frequently done to provide information on the general spectrum of pollution bacteria. Distribution system samples all receive the P-A test. However, 15-20% of these samples also get an MF test to determine the level of pollution in cases when the entire system has been polluted.

Literature describing the procedure and giving further information is available from the Ministry of the Environment, Laboratory Services Branch, Microbiology Section, P.O. Box 213, Rexdale, Ontario, Canada.

(Clark - 248-3008).

THE RELATIONSHIP BETWEEN SELENIUM AND MERCURY IN ONTARIO FISH

Selenium, like sulfur, has a strong tendency to complex with heavy metals. Numerous animal studies have indicated that selenium interacts with heavy metals in such a manner as to lessen the toxic effects of the metal. In recent years, there has been a growing body of evidence

suggesting that mercury's toxic effects are lessened by selenium, and that for certain organisms, the levels of these two elements are fairly well correlated. Studies on tuna, Japanese quail, and some mammals show that the molar ratio between mercury and selenium is constant, indicating that both elements are accumulated to about the same extent by the organism.

The study reported here was carried out to determine whether such a relationship exists in Ontario fish, where it would have obvious ramifications concerning Ontario's mercury fish-testing program. If such a relationship was found between mercury and selenium, the environmental and health hazards associated with mercury in fish would be diminished.

The first phase of the study was to develop precise, accurate, and sensitive analytical procedures that could be applied to large numbers of fish samples. Five procedures were examined, as reported in the last issue of "ANALYSIS". The hydride generation - flameless atomic absorption spectroscopy (FAAS) technique was chosen for the study because it met the analytical requirements and was fast (40 fish/day). Mercury was analyzed by the Hot Block-FAAS technique.

Two separate sampling surveys were carried out. In one, various species of freshwater fish (Northern pike, smallmouth bass, carp, etc.) with different feeding habits and trophic levels were collected from the Toronto Harbourfront area, Lake Huron, Lake Superior and several other lakes. These were analyzed for selenium and mercury. The areas were chosen to represent industrialized and non-industrialized situations. The mercury level varied from species to species and between locations for a given species, but the selenium content remained relatively constant. No correlation was found between the selenium and mercury concentrations for any species from any location.

In the second phase of the experiment, one species (Pickerel : Stizostedion vitreum) was collected from various lakes across Ontario. The sampling locations were selected to represent industrialized and non-industrialized situations in the Great Lakes and in smaller, inland lakes. Again, no relationship between selenium and mercury levels in the pickerel was found.

Selenium was found in all fish which were analysed, but in no case did levels approach those which have been reported in marine fish. However, the mercury levels ranged from natural levels to very high (>5 ppm) concentrations, depending on the location and its degree of industrialization.

(Bishop - 248-3031).

THE ANALYSIS OF MERCURY IN HUMAN BRAIN SAMPLES

Sections of the Wabigoon-English River system in northwestern Ontario have been contaminated by mercury discharged between 1962 and 1970 by a chlor-alkali plant in Dryden, Ontario. Fish from a number of lakes in this area have very high mercury concentrations, and yearly samplings of the fish have indicated no significant decline in the levels.

Native peoples on two reserves, Grassy Narrows and Whitedog, use fish from some of the affected lakes as part of their diet. Concern has been raised that the consumption of these fish might lead to dangerous accumulations of methylmercury in some natives, and result in symptoms of methylmercury poisoning. The Environmental Health group of the Ministry of Labour has arranged with Health officials in Kenora that all natives from these reserves who die have an autopsy performed. The brains are removed, and either frozen or preserved in formalin, or fresh, they are transported to Toronto. In Toronto, the brains are sectioned (up to sixteen sections per brain) and part of these sections are reserved for histological analysis for possible pathological damage that could be attributed to methylmercury poisoning.

The remainder of the brain sections are reserved for chemical analysis. Mercury analyses are performed at the Ministry of Labour Radiation Protection Laboratory, and at the Mercury Laboratory of the Ministry of the Environment. The Radiation Protection Laboratory uses a differential reduction-cold vapour atomic absorption method for determining total and "organic" mercury. The MOE mercury laboratory uses its standard procedure for the determination of total mercury in biomaterials: acid digestion, followed by

reduction and cold vapour atomic absorption. Each brain section is also analysed for methylmercury by a slightly modified version of the procedure used for methylmercury in fish muscle: acidification of the homogenized sample, extraction into benzene, cleanup extraction into aqueous sodium thiosulfate, then back extraction into benzene, with gas chromatographic analysis. In addition, many of the brain sections have been analyzed for their selenium content, using an acid digestion, hydride generation, flameless atomic absorption method.

The results of these analyses have been used by the Ministry of Labour to determine the amount of methylmercury accumulation in native peoples living close to mercury contaminated water bodies, and sometimes consuming fish with elevated levels of methylmercury. The details of the study, and a summary of the preliminary findings, can be found in the report from the Ministry of Labour "Tissue Mercury Levels and Histological Assessment of Brains from Deceased Residents of Northern Ontario".

(Bishop - 248-3031).

NICKEL IN BLOOD AND URINE

The possible chronic effects of long-term nickel exposure are not well-known. Although it has been considered relatively innocuous, recent studies have suggested that certain forms of nickel may be carcinogenic, embryotoxic or both.

The Laboratory Branch was approached by the Ministry of Health to develop a technique for the analysis of nickel in blood and urine and to take part in a survey of nickel levels in Port Colborne citizens within and without the INCO plant located there.

An earlier study in Sudbury had revealed somewhat elevated levels of nickel in blood and urine of subjects in comparison to relatively unexposed individuals. The work was limited in scope and did not attempt to draw any conclusions regarding nickel toxicity. The situation was also complicated by the fact that it is difficult to determine whether the elevated blood and urine levels are a result of inhalation or ingestion.

The proposed study will be much more extensive, and evaluated in conjunction with medical and mortality data. Since the Port Colborne water supply has low nickel concentrations, any elevated blood or urine levels should be due primarily to airborne exposure.

The analytical work is quite challenging. Normal levels in blood and urine are 1-3 ug/l, well below normal flame atomic absorption detection limits. In order to achieve adequate sensitivity, it is necessary to first solvent extract the samples and then determine the nickel levels in the extracts by carbon furnace atomic absorption spectroscopy. At these ultratrace levels, contamination problems are severe and obtaining reagents of sufficient purity to maintain adequately low blank levels becomes very difficult. At the present time development work is proceeding well and methods of extraction and FAAS analysis have been provided and are being compared in order to establish the optimum procedure in terms of speed, accuracy and sensitivity.

(Bishop - 248-3031).

THE AUTOANALYSIS OF MERCURY

Because of the continuing concern over the levels of mercury in Ontario fish, demands for mercury analysis have greatly increased in the past three years.

In order to meet this demand, an automated procedure was developed which allowed us to increase production from 250 to 350 samples per week while maintaining the same staff level. The precision of the automated procedure has proven to be identical to that of its manual counterpart and spike recoveries appear to be slightly better, averaging 97% compared with 93% for the manual procedure. Recently, a second automated system has been assembled resulting in another production increase to 450 samples per week.

Despite these efforts, at the time of writing there are 4000 fish samples outstanding in our freezers and at least that many again in the field awaiting submittal. Laboratory staff, in considering ways to handle these ever increasing sample pressures have designed a unique, minicomputer- controlled analysis system.

At present, samples are weighed into test tubes and the weights recorded. The run is then acid digested in a hot block and transferred to the autoanalyzer where the samples are analysed. The results are recorded as peaks on a strip chart recorder. Concentrations are calculated by comparing the peak heights of samples and standards and referring back to the sample weights. These data are then manually entered into a computer where they are statistically evaluated by lake, species and size in order to determine whether the fish are safe to eat.

In the proposed system, all operations are computer- controlled. The pertinent data concerning the fish, species, location, size, etc., will be entered prior to weighing. Weights are automatically stored and reunited with the autoanalyzer output after analysis. Calculations are completed and the results displayed. If the data is acceptable, it can then be transferred by the minicomputer to a larger instrument for statistical evaluation.

The time saved is estimated at 25% and since the one computer can control several autoanalyzers, there will be future time saved. It is hoped that this pioneering work in autoanalysis should allow us to meet the current need while minimizing errors and removing much of the tedium associated with the present operation.

(Bishop - 248-3031).

CHLORINATION OF AROMATIC HYDROCARBONS UNDER STP POSTCHLORNATION CONDITIONS

Benzene + Cl_2 ——→ Chlorobenzene and Dichlorobenzenes.

A student writing this chemical equation on an organic chemistry exam would doubtless fail his course. Students of organic chemistry must know that chlorination of the aromatic nucleus is an electrophilic aromatic substitution reaction which, in this case, would take place under anhydrous conditions and would require the application of a Friedel-Crafts type catalyst (Fe Cl_3, Al Cl_3). To use hypochlorite or aqueous chlorine would be considered not only ridiculous but anti-chemistry heresy.

We had somewhat similar feelings when it was proposed that chlorinated byphenyls may be formed from biphenyl during chlorination of sewage treatment plant effluents. But, since the environmental chemist is accustomed to facing unpredictable phenoma, and because the question has important ramifications, it was decided to investigate the matter more closely.

It was hoped that a brief experiment would put an end to such speculation. If byphenyl does not react with chlorine in distilled water, one would not expect the reaction to take place in sewage effluents where ammonia and a plethora of organics would compete for the halogen.

A 2 mg/l solution of biphenyl was prepared in organic-free water and treated with high purity chlorine gas (40 ml/min. for 25 min.) at room temperature. After 8 hours, the hexane extract of the reaction mixture was analysed by gas chromatography-mass spectrometry.

The analysis revealed the presence of two monochloro-biphenyls, four isomeric dichlorobiphenyls and traces of trichloro and tetrachlorobiphenyls.

Another reaction, carried out as above but with the addition of 100 ppm ammonia demonstrated the powerful inhibiting effects of the latter. In this case, chlorination practically stopped at the monochloro stage.

With benzene, up to four chlorine atoms were introduced in the absence of ammonia.

Chlorination of aromatic hydrocarbons under such mild conditions is rather surprising, and the accepted classical reaction mechanism for this reaction will have to be re-examined. A more detailed study is now underway in our laboratory.

While the feasibility of the reaction leading to chlorinated byphenyls is now well demonstrated, chlorination of sewage treatment plant (STP) effluents, because of their chemical complexity, may not be considered a significant contributor to the PCB pollution of the environment. This seems to be supported by a recent study involving four Ontario STP's known to receive biphenyl-containing undustrial wastes as well as trace amounts of PCBs:

	Total PCBs (ppm)	
	Before Chlorination	After Chlorination
STP #1	0.041	0.042
STP #2	0.053	0.055
STP #3	0.038	0.026
STP #4	0.016	0.042

(O. Meresz - 248-3031).

MICROBIOLOGY QUALITY ASSURANCE PROGRAMS

Setting up quality assurance programs in a media preparation laboratory presents some unique problems. Since little information is available on the problems and pitfalls involved in the preparation and storage of media, few laboratories implement strict quality control programs. In contrast, such programs are in routine application, e.g., in chemistry and haematology laboratories where the determinations are quantitative and results can usually be analyzed statistically. The fact that reference standards may be easily obtained commercially facilitates this.

Major sources of error in a microbiology laboratory include improper preparation or storage of media, equipment malfunction, inadequate cleansing or sterilization of glassware and impure water supplies. Our quality assurance program was designed to ensure reliability and reproducibility of results with minimal effort and expense by monitoring these problem areas.

Establishment of such a program entailed the preparation of a list of procedures, materials and equipment which is periodically updated. A routine timetable was then set up in accordance to the priorities specific to the laboratory involved. These priorities reflected the likelihood of deficiencies based on previous observations and the relative importance of the variable considered. High priority areas in media surveillance include sterility checks, pH, storage restrictions and testing of performance with stock cultures. Under equipment maintenance, the items of highest priority include refrigerators, incubators, water baths, laminar air flow cabinets, autoclaves and hot air ovens. Surveillance of microscopes, balances and glassware is given less emphasis, but maintenance of a frequently updated methods manual is of high priority.

Implementation of the programs must also be monitored. This is most efficiently accomplished by the preparation of a monthly surveillance report which should indicate whether or not surveillance has been conducted as scheduled, and whether deficiencies were observed and the necessary corrective action taken.

Quality control must also extend to personnel, and frequent performance evaluations through the use of simulated water samples or proficiency test specimens are recommended. On a monthly basis, in the Microbiology Section, well mixed water samples are divided and distributed among the laboratories as part of the routine workload. By comparing the final results, we have become aware in initial testing, of minor discrepancies in incubation temperatures, counting methods and dilution preparation. Proficiency testing should be conducted more frequently during the summer months when the sample load is relative heavy and the temporary personnel less trained.

Another aspect of quality control to be considered is laboratory safety. Employees must be made aware of occupational health and safety hazards involved in microbiology. Adequate precautions should always be taken to prevent the spread of microorganisms. Precautions taken include swabbing of bench areas with a broad spectrum disinfectant, the use of plugged pipettes and effective decontamination of contaminated media and glassware. A safety checklist should be drawn up with regular inspections and a recording of findings and corrections.

We have found during the past two years in the Microbiology Section that the time and expenditures involved in monitoring the materials and equipment have saved many hours on test repetition and equipment repairs. We can also have considerably more confidence in the results and data reported.

The quality assurance programs applied in the Microbiology Section's Media and Taxonomy Laboratories are organized into five major areas: media, equipment, glassware, water quality, and proficiency testing. Detailed procedural instructions for each of these may be found in the report on "Microbiology Quality Assurance Programs", including recommendations for the recording and reviewing of quality control data.

(Pagel - 248-3008).

TRACKING DOWN COMPLAINT SOURCES

The analysis of samples collected in connection with complaints from the public is an essential service. Complaints are usually investigated by the Ministry's regional staff and in many instances analyses of samples collected during the investigations are required. In these cases considerable analytical support is needed because of the increasingly large number of samples involved, the limited amounts of any given sample generally available for examination and the widely varied nature of the samples.

Most samples require particle identification and are generally first examined by means of an optical microscope. If the particle size is sufficiently large, definitive identification is often possible. For smaller particles (< 5 um in diameter) an electron microprobe is used. With this instrument, it is possible to obtain an elemental analysis of individual particles, and an indication of the compounds present. If sufficient sample is available, compounds may be positively identified by X-ray diffraction analysis. Identification of organic compounds is achieved through infrared spectroscopy, gas and liquid chromatography and mass spectrometry.

Examples of some of the problems that have been solved using these diagnostic tools are given below:

Corrosion of Galvanized Iron

At a plant manufacturing galvanized iron structures, the surfaces of pieces stored in the plant yard were found to be coated with a white powder, which was claimed to be due to air pollution. Analysis of the white material by X-ray diffraction showed it to be composed of zinc oxide and zinc carbonate. This indicated that the corrosion was due to the action of carbon dioxide and moisture and not to sulphur dioxide as originally suspected.

Cement Plant Emissions

Complaints were received from the owners of a motel, located in the vicinity of a cement factory and a plant manufacturing gypsum boards. Cars at the motel were frequently found to be covered with a white dust which was difficult to remove. Samples were collected from the cars and from various bag houses in the two plants. Using X-ray diffraction, the samples from the cars were shown to be identical to one of the intermediary cement products, thus pinpointing the source of the emissions.

Sewage Treatment Plants

Samples of insoluble deposits causing problems in sewage treatment plants are often submitted for identification. Generally, the materials encountered are a mixture of clays and decayed organic matter. In one plant, however, on several occasions, the material causing the problem was identified as calcium oxalate (weddellite). In another plant, magnesium ammonium phosphate (struvite) was identified. The sources for the chemicals which could react to form these minerals have not as yet been traced.

Pink Snow

Last winter, residents in a large area in the west end of Toronto were surprised to see the snow on their property turn pink. Snow samples, together with samples of dyes from a suspected emission source, were collected by field staff and submitted to the laboratory. Particulate matter,

filtered from the melted snow, was compared to the dyes by means of optical microscopy and electron microprobe analysis. A similarity was observed in appearance and trace metal content, between fallout samples and one of the dyes, Rhodamine B. The samples were further analyzed by IR and UV spectroscopy and the initial findings confirmed. The relatively simple solution to this problem emphasizes the importance of collecting samples for comparison purposes wherever possible.

Coal Dust Complaint

A resident in the vicinity of the Ontario Hydro power generating plant in Nanticoke complained that dust from the coal piles of the plant was causing loss of enjoyment of his property. On consultation with field staff, a sample from the property (a piece from a plastic picnic table cover) was obtained for analysis. On visual observation, a black material, very similar to coal dust in appearance, was found to be present. Examination under an optical microscope at a magnification of 400X showed the black material to be a fungus. To confirm this finding some of the material was incubated in an antibacterial culture medium, prepared especially for fungal growth. The proliferation of the fungus proved conclusively that coal dust was not the cause of the nuisance.

Aluminum Siding Damage

A problem of air pollution damage to aluminum house sidings was brought to the Ministry's attention. About 20 houses, located in a resort area on the shoreline of Lake Erie, were affected. The area was relatively remote from any evident source of pollution. On examination of the siding with a magnifying glass, pitted spots were observed, usually surrounded by what appeared to be insect droppings.

The largest number of these spots was found near outdoor lights of the buildings. Samples were removed from the damaged sidings by means of a scalpel or by lifting the material using adhesive tape. These samples, after further preparation, were examined in a scanning electron microscope at magnifications of up to 1000X and a fungus, together with spores was seen in each spot. It is speculated that the fungus was using the insect droppings as a nutrient, and that resulting acidic decomposition products attacked the enamel of the siding, exposing aluminum metal to atmospheric corrosion.

(Pimenta - 248-7101).

THE BACTERIOLOGICAL LAKESHORE CAPACITY STUDY

The continuing pressure from the public for "a cottage at a lake" has led to concern over widespread lakeshore overdevelopment, and the subsequent lowering of the water quality of small freshwater lakes, an important Ontario natural resource. It was recently shown that single tier cottage development is associated with increased fecal pollution of lakewater. The health risks accompanying this deterioration in water quality have not yet been accurately assessed.

Pseudomonas aeruginosa has been advocated as the best bacteriological parameter of recreational health risks. This bacterium may cause a painful ear infection (otitis externa) in swimmers. It was estimated that there may be about 15,000 cases of otitis externa among swimmers at cottages in Ontario each year.

A current study of eight Muskoka lakes has shown that numbers of P. aeruginosa are significantly associated with cottage developed shorelines, and even higher numbers are found at public beaches.

A suitable method was available for the determination of P. aeruginosa in water samples (Levin and Cabelli), but the analysis for the presence of this bacterium in sediments was found to be time-consuming and costly. Therefore, one study objective is to develop a better method of isolating P. aeruginosa from sediment samples. Another objective is to establish P. aeruginosa as a criterion of recreational water quality.

Future studies are to be carried out, at more densely populated and developed lake sites than those with single tier cottage development.

(Burger - 248-3008).

RECENT PAPERS AND REPORTS PREPARED BY LABORATORY STAFF

PAPERS

J. Bishop and B. Neary. The Distribution of Mercury within the Tissue of Freshwater Fish. Proc. Fifteenth Annual Handford Life Science Symposium, Richland, Washington, September 29-Oct. 1, 1977. P. 452-464.

J. Bishop and B. Neary. The Decline of Mercury Concentration in Fish from Lake St. Clair. Presented at Fourth ICES Invitational Symposium, Chapel Hill, N.C., June 4, 1977.

J. Hipfner. Infra-red Reflect Analysis of Aquatic Vegetation and Sediments for Nitrogen, Phosphorus and Ignition Loss. Presented at 1977 Pittsburg Conference, Cleveland, Ohio. February 28-March 4, 1977.

M. Moselhy and D. Boomer. Multielemental Diagnosis of Environmental Materials by Rotrode Direct Reading Spectrometry. Published Paper, Can. J. Spectroscopy, August 1977.

F.C. Darcel. Fractional Extraction Procedures for Environmentally Significant Inorganic Ions in Sediment, Soils and Mine Tailings. Presented at Can. Mineral Analysis Conference, Flin Flon, Man., September 1977.

R. Sadana. Heavy Metals in Sudbury Environment. An Overview, presented at the Sudbury Environmental Study Seminar, 1977.

D. Rokosh. Aquatic Microbial Population Changes Subsequent to Liming of Lakes in the Sudbury Area. Presented at the Sudbury Environmental Study Seminar (1977).

J. Evans. Automated Distillation Procedure for Ammonia Analysis. Presented in Detroit (FACCS) in November 1977.

J. Crowther. An Autoclave Digestion Procedure for Determining of Total Iron Content of Waters. Accepted for Publication in Analytical Chemistry.

R.D. Smillie, T. Sakuma and W.K. Duholke. Low Molecular Weight Aromatic Hydrocarbons in Drinking Water. Journal of Environmental Science and Health, Part A, Environmental Science and Engineering.

R.D. Smillie, D.T. Wang and O. Meresz. The Use of a Combination of Ultraviolet and Fluorescence Detectors for the Selective Detection and Quantitation of Polynuclear Aromatic Hydrocarbons by High Pressure Liquid Chromatography. J. Environmental Science Health A 13, 47 (1978).

R.D. Smillie. Chloroform Levels in Ontario Drinking Waters. Water and Pollution Control, 115, 8 (1977).

O. Meresz, W.K. Duholke, T.J. Ma and T. Sakuma. Identification of Fish Tainting Pollutant by GC/MS. Presented at the 26th International Congress of Pure and Applied Chemistry, September 1977 in Tokyo, Japan.

R.S. Thomas, R.C. Lao, D.T. Wang, D. Robinson and T. Sakuma. Determination of Polycyclic Aromatic Hydrocarbons in Atmospheric Particulate Matter by GC/MS and HPLC. Presented at the 26th International Congress of Pure and Applied Chemistry, September 1977, in Tokyo, Japan.

J.F. McDonald, M. Hach, D. Mozzon, A. Nicholson and V. Ozvacic. Development of a Source Sampling Technique for Toluene Diisocynate. Presented at the 70th Air Pollution Control Association Meeting, June 1977 in Toronto, Ontario.

O.W. Berg, R.B. Caton, R.D. Smillie and R.D.S. Stevens. An Ambient Air Survey for Chlorinated Biphenyls in Ontario. Presented at the 70th Air Pollution Control Association Meeting, June 1977 in Toronto, Ontario.

REPORTS

B. Neary. A Review of Mercury Levels in Fish From The Wabigoon-English and Winnipeg River Systems to 1977.

B. Loescher. Automated Analysis of Mercury in Fish.

J. Bishop and B. Neary. Health Implications of Contaminants in Fish.

J. Hipfner. Sulfur Speciation and Analysis of Atmospheric Samples.

D. Boomer. An Outline of the Present Capabilities of the Emission Spectrograph as Applied to the Analysis of Sediment Materials.

G.A.V. Rees. Use of XAD-2 Macroreticular Resin for the Recovery of Ambient Trace Levels of Pesticides, Herbicides and Industrial Organic Pollutants from Water.

Pat Baulu. The Determination of Abate in Aquatic Systems.

J.E. Pagel. Microbiology Quality Assurance Programs, 1976.

J.A. Clark. The Enumeration of Pollution Indicator Bacteria.

J.A. Clark. The Presence-Absence Procedure.

A.A. Qureshi. Microbiological Characteristics of Stormwater Runoffs at East York (Toronto) and Guelph Separate Storm Sewers.

G.S. Hendry. Relationships Between Bacterial Levels and other Characteristics of Recreational Lakes in the District of Muskoka.

S.P. Villard, C.E. Simpson. Effect of Maximum Lake Depth on Acute Fall Hypolymnetic Oxygen Depletion.

J. Crowther and M. Hutt. Colorimetry Change for Total Kjeldahl Nitrogen Determination.

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